Kasetsart Journal of Social Sciences 41 (2020) 321–328

Kasetsart Journal of Social Sciences

journal homepage: http://kjss.kasetsart.org

Livelihood changes of affected households under resource scarcity: The Son La hydropower project in Vietnam

Thi Minh Hang Bui [a, *], Pepijn Schreinemachers [b]

[a] International Cooperation Center for Training and Study - Abroad, TNU University of Economics and Business Administration, Thai Nguyen 250000, Vietnam
[b] World Vegetable Center, Bangkok 10903, Thailand

Article Info

Article history:
Received 6 March 2018
Revised 12 July 2018
Accepted 22 August 2018
Available online 13 September 2018

Keywords:
adaptation,
resettlement,
resource scarcity,
Son La hydropower project,
sustainable livelihoods

Abstract

This study analyses changes in livelihoods of resettled and host households affected by the Son La hydropower project in Vietnam. Data come from a questionnaire survey of 52 host and 56 resettled households in five villages affected by the project and refer to the situation before, immediately after and 5-years after the resettlement. Data were analyzed using descriptive statistics, decomposition analysis and linear regression. Resettled households, and to lesser extent also host households experienced a decline in rice yields, income and an increase in food insecurity. There is a discrepancy between the government resettlement plan and reality. Compensation payments alone appear inadequate to rebuild and maintain livelihoods and a more direct approach is needed to create economic opportunities in the affected communities.

© 2018 Kasetsart University. Publishing services by Elsevier B.V.

Introduction

Large hydropower dams make an important contribution to the economic growth of many mountainous countries, but such dams are also observed to create adverse impact on local communities displaced by dams and reservoirs (Kevin, Longyi, & Mark, 2016; Singer, Pham, & Hoang, 2014). Involuntary resettlement is often an unavoidable consequence and one of the most controversial issues surrounding large dam projects. Resettlement induces fundamental changes to people's lives and livelihoods such as landlessness, homelessness, joblessness, marginalization, and loss of access to common property (Cernea, 1997) and some of these effects can be long-lasting (Webber & McDonald, 2004). Resettled people often have to reconstruct their livelihoods under conditions of resource scarcity and some have failed to create sustainable livelihoods leading to long-term hardship and impoverishment (Cernea, 2008; Scudder, 2001). Scudder (2005) identified that only 7 percent of the large dam projects (three out of 44 cases surveyed) improved the living standards of the resettled people while living conditions worsened in 82 percent of projects.

In Vietnam, hydropower contributes to about 46 percent of total power generation. Currently there are 58 large new hydropower plants with a capacity of over 10 MW planned or under construction. Hydropower projects are nowadays required to have a resettlement master plan to ensure that displaced people can rebuild and maintain their livelihood after resettlement. Several policy instruments have been developed by the government of Vietnam to effectively implement resettlement programs, ranging from direct means such as compensation payments for incurred losses, financial support for rebuilding livelihoods, and indirect support such as agricultural extension and vocational training. Despite the government's effort to create sustainable livelihoods, there is a considerable discrepancy

* Corresponding author.
E-mail address: hangbui.tn@gmail.com (T.M. Hang Bui).
Peer review under responsibility of Kasetsart University.

https://doi.org/10.1016/j.kjss.2018.08.004
2452-3151/© 2018 Kasetsart University. Publishing services by Elsevier B.V.

between the goals of resettlement projects and reality and many resettled people in Vietnam are observed to be unable to reconstruct their livelihoods at the new location (Singer et al., 2014).

This study focuses on resettled and host households affected by the Son La hydropower project (SLHP). Bui, Schreinemachers, and Berger (2013) conducted a quantitative case study in a resettlement commune of this project in 2009. They found that the resettled households could restore their living standards right after resettlement due to a large amount of compensation and support payments from the government. However, they also found that livelihood adaptation of both host and resettled households was strongly conditioned by a lack of available livelihood assets and questioned whether households would be able to maintain livelihood outcomes after payments end. As the data were collected immediately after resettlement, the study only gave a snapshot of the adaptation processes and coping strategies that were employed right after resettlement. The current study followed-up with the same households to gain a better understanding of the process of livelihood change after government payments ended. In addition, this study elucidates the role of government payments in resettled households' livelihood rehabilitation process in the long-term.

Methods

Son La province is located in the northern uplands of Vietnam. This region is among the poorest in Vietnam due to its unfavorable socio-economic characteristics (low education, high rate of poverty, poor access to market and finance), its rugged upland terrain and poor infrastructure. The region has a low level of urbanization, a high importance of agriculture in the local economy and a large ethnic minority population.

The SLHP is the largest dam project in Vietnam in terms of annual capacity but also in terms of the area of inundated land and the number of people forced to relocate. The dam construction submerged 25,101 hectares (ha) of land, including 9,077 ha of agricultural land, which already is a scarce resource in the region. It required the relocation of 92,301 people in three provinces (Son La, Dien Bien, Lai Chau) between 2005 and 2010 (Government of Vietnam, 2013), although the implementation took until 2015 (see Bui et al. (2013) for more details).

The implementation principles of resettlement are to enable people to quickly recover their livelihoods and, based on the natural resources at the new location, to gradually restructure the local economy to increase production, incomes and well-being of the people (Government of Vietnam, 2004, 2013). The resettlement policy of SLHP envisaged that the benefit of the dam would be shared with the affected people. Government documents clearly stipulate compensation, assistance and support after resettlement. However, most of these payments are in the form of cash and these payments are only paid to resettled households, not to host households despite them also being affected by the project. Possible livelihoods were identified for each resettlement zone, but the resettlement plan did not include specific measures for how to achieve these. Although "job change/career change" was mentioned in the resettlement plan as a solution to cope with the agricultural land scarcity, this may not be a viable option for many resettled people as low education or old age makes their labor uncompetitive.

Data for this study were collected from the Muong Lum commune, one of 272 resettlement sites of the SLHP. Muong Lum is a remote mountainous commune located in Yen Chau district, Son La province. In 2008, 67 Black Thai households from the dam location were relocated to five Black Thai villages where a host community already existed. The host community was reliant on paddy cultivation and some paddy land was taken from the hosts and distributed to the new households. Some previously uncultivated land on the mountain slopes was also taken into cultivation. Agriculture in Muong Lum is characterized by small-scale production. This is because of scarcity of agricultural land and the fact that farmers have little incentive to expand production. A tangible benefit of the resettlement program was an improvement in road quality connecting Muong Lum to the district center as well as to the national highway connecting the district to Hanoi. However, market access is still limited as it is time-consuming and costly for the farmers to bring their products to the district market and traders are not willing to come to the commune to buy small amounts of products.

A survey was administered to collect data in the five Black Thai villages of the commune in 2013, five years after resettlement. A first survey was conducted in 2009 and the 2013 survey visited the same households. We intended to sample all resettled households for the study, but some were not available for the interview and the sample was therefore 56 resettled households. The sample of 52 host households was selected randomly from a list of all host households provided by the people's commune. A structured questionnaire was used to capture quantitative aspects of the households' livelihood assets, strategies and outcomes across 108 selected households. Both surveys were conducted at the same time of the year to reduce the effect of seasonal variations in livelihood outcomes such as income and food security. Focus group discussions (one per village, including 7–8 household heads) were used to gain a deeper insight into the households' adaptive strategies and constraints to apply these strategies.

Definition and measurement of key variables are the same as described in Bui et al. (2013). Livelihood outcomes were quantified in three ways: farm output, household income and food security. Food security was measured as the number of food insecure households, based on per capita daily calorie intake using the Household Food Insecurity Access Scale (HFIAS) (Coates, Swindale, & Bilinsky, 2007). Monetary values from 2007 to 2009 were converted to 2013 values using the Consumer Price Index (CPI) for rural areas of Vietnam. To examine factors influencing rehabilitation of household income right after and five years after resettlement, the following function was estimated using ordinary least squares regression:

Household income $= f$(Household demography, Participation in training programs, Membership of associations, Arable land, Farm animals, Access to credit, Planting cost, Government payments).

Decomposition analysis (Fields, Cichello, Freije, Menéndez, & Newhouse, 2003) was used to quantify the relative contribution of each factor. The inequality of the dependent variable was decomposed using so-called factor inequality weights. Larger positive weights for a given explanatory variable mean that it contributed more to the inequality of the dependent variable, while negative weights imply that it caused the dependent variable to be more equally distributed.

Results

Household Assets

Table 1 compares livelihood assets of host and resettled households immediately after (2009) and five years after resettlement (2013) when the compensation and support payments ended. There were no significant changes in the area of sloping land of host households but their paddy land area reduced from 0.26 ha to 0.19 ha, partly because they sold it or divided the land when a family member married. The sloping land area of resettled households increased significantly, most likely from reclaiming previously uncultivated areas. However, it should be noted that this land was reported as less productive compared to the land already in use. The paddy land owned by resettled households did not change. Both resettled and host households assessed that their agricultural land had become less fertile since the resettlement.

Use of Compensation and Support Payments

Resettled households were compensated for loss of assets and they also received cash support for food and basic services. All compensation payments were paid in 2009 while support payments were planned to be paid for two years after resettlement. During the focus group discussions and the individual interviews, resettled households indicated that they were satisfied with the received government payments. The total amount received was 7,562 US dollars on average per household. Figure 1 shows that 42 percent was used to build houses, 29 percent for daily expenses, 13 percent was spent on buying furniture, motorbike and home electronics, 12 percent was invested in crop production (seeds, chemical fertilizers or non-durable tools), and only 1 percent was invested in livelihood assets (livestock, buying agricultural land or durable production assets).

Adaptation Strategies

Bui et al. (2013) observed that resettled households copied the input use decisions of host households right after resettlement. Five years after resettlement, resettled households continued to intensify their use of chemical fertilizers as a strategy to cope with land scarcity (Table 2). Both host and resettled households maintained their input use, and some even used larger quantities of chemical fertilizers due to the small amount of land and the decrease in land quality as explained in the non-structured interviews. Resettled households in particular appeared to intensify their use of paddy land as they used a considerably larger amount of chemical fertilizers per hectare of paddy land than host households. However, this did not translate into higher rice yields (Table 2), likely because of lower land quality and possibly because of fertilizer overuse. It should be noted that due to cash constraints, both groups had to borrow money from traders to pay for fertilizers and pay this back after harvest, and this posed a financial risk of being indebted if the maize or rice harvests were lower than expected. Table 3 shows that the overall cost of crop input use and livestock input use increased significantly for resettled and host households. Both groups intensified their land use by growing more crops per year as the proportion of land cultivated with rice and maize increased significantly.

In 2009, 80 percent of host households and all resettled households grew hybrid maize variety LVN10. In 2013, households had adopted new varieties that were expected to give higher yields and adoption of these varieties was 93 percent for resettled households and 73 percent for host households (Table 4). The proportion of households having adopted improved rice varieties was much lower than for maize and host households appeared more willing to adopt improved rice varieties than resettled households.

The income composition data show that crops still contributed a large part of the incomes of both resettled and host households, but were no longer the largest income component (Figure 2). Livestock rearing had become the most important income source for both groups and the

Table 1
Livelihood assets of resettled and host households immediately after (2009) and 5-years after (2013) resettlement

Variable	Resettled Households ($n = 56$)			Host Households ($n = 52$)		
	2009	2013	% Change	2009	2013	% Change
Paddy land (ha)	0.12 (0.03)	0.12 (0.03)	0	0.26 (0.17)	0.19 (0.11)	−27***
Sloping land (ha)	0.29 (0.22)	0.93 (0.38)	221***	0.51 (0.22)	0.57 (0.22)	12
Quality of arable land (1–5)	2.99 (0.51)	2.55 (0.60)	−15***	2.62 (0.74)	2.42 (0.60)	−8**
Farm animals (TLUs)[a]	1.49 (1.54)	1.42 (0.96)	−5	3.27 (1.96)	3.28 (3.28)	0
Available savings (thousand US dollar)	1.34 (1.61)	0.68 (1.83)	−49***	0.22 (0.56)	0.31 (1.19)	41
Possible sources of credit (number)	3.79 (1.23)	1.98 (1.23)	−48***	3.11 (1.38)	1.60 (1.09)	−49***
Membership of associations (number)	3.52 (1.85)	2.34 (1.96)	−34***	4.46 (2.38)	2.92 (2.07)	−35***
Reliance on network in case of shock (families)	3.11 (0.53)	2.71 (0.85)	−13***	3.12 (0.59)	2.57 (1.18)	−18***

Note. Averages per household. Standard deviations in parentheses. Significance tests refer to a Student's t-test of the difference in means for continuous variables: ** $p < .05$, *** $p < .01$

[a] Tropical Livestock Units for East and South East Asia, as based on Chilonda and Otte (2006)

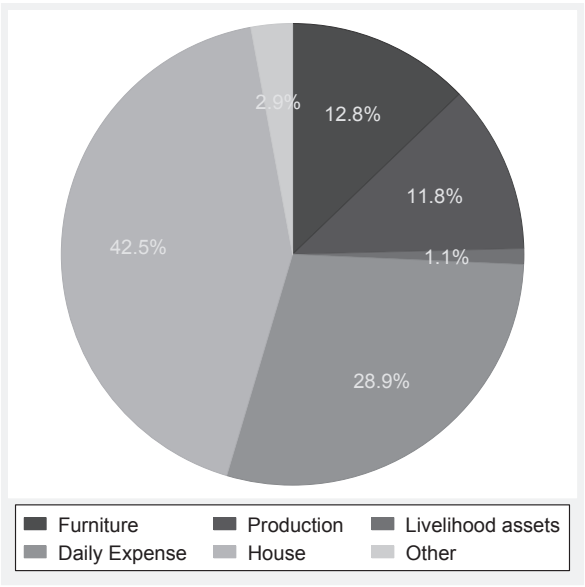


Figure 1 Use of compensation and support payments by resettled households, in percent of the total payment received by the average household

Table 2
Chemical fertilizer use and crop yields among resettled and host households immediately after (2009) and 5-years after (2013) resettlement, in kg/ha

Fertilizer type/Crop yields	Resettled Households ($n = 56$)			Host Households ($n = 52$)		
	2009	2013	% Change	2009	2013	% Change
Maize						
NPK use	64.31 (209.85)	499.65 (231.63)	677***	355.95 (249.96)	725.95 (347.93)	104***
Urea use	1.85 (9.27)	58.90 (55.64)	3084***	54.26 (93.88)	154.96 (152.68)	186***
Yield	7321.40 (2650.93)	5900.55 (1914.77)	−19***	8179.37 (3000.91)	8600.35 (3609.24)	5
Paddy rice - spring						
NPK use	1124.15 (573.80)	2226.55 (1000.62)	98***	1301.28 (813.16)	1657.12 (997.04)	27**
Urea use	379.70 (195.57)	587.75 (361.60)	55***	310.54 (295.24)	475.98 (382.29)	53***
Yield	5017.92 (1280.82)	5209.51 (2024.64)	4	5458.69 (1744.09)	5570.60 (1940.42)	2
Paddy rice - summer						
NPK use	988.43 (579.02)	1617.47 (924.62)	64***	907.25 (627.88)	1294.79 (933.82)	43**
Urea use	290.68 (177.99)	504.82 (237.56)	74***	230.46 (253.87)	337.47 (250.49)	46**
Yield	4808.48 (1633.01)	3023.95 (1519.92)	−37***	4440.19 (1202.74)	4172.47 (1894.96)	−6

Note. Averages per household. Standard deviations in parentheses. Significance tests refer to a Student's t-test of the difference in means: ** $p < .05$, *** $p < .01$

share of income from aquaculture had also increased. The share of income derived from collecting forest products increased for the host but not for resettled households. However, this should be considered as a temporary income source as the government has tightened its regulations and enforcement of forest use in response to rapid deforestation and forest degradation in Vietnam.

After five years in the new location, resettled households had not been provided with employment opportunities and had not received support for career change, although this was promised in government documents. From our survey in 2013, we found that in 7 percent of resettled and 6 percent of host households, one or more members had migrated to find jobs elsewhere; this was

Table 3
Agricultural livelihood strategies of resettled and host households immediately after (2009) and 5-years after (2013) resettlement

Strategy	Resettled Households ($n = 56$)			Host Households ($n = 52$)		
	2009	2013	% Change	2009	2013	% Change
Crop input use (thousand US dollar)	0.21 (0.20)	0.47 (0.22)	124***	0.42 (0.18)	0.62 (0.32)	48***
Livestock input use (thousand US dollar)	0.26 (4.63)	0.33 (0.08)	27**	0.35 (0.28)	0.45 (0.38)	29*
Cultivated upland (%)	72.17 (36.23)	90.79 (25.00)	26***	82.44 (21.81)	90.42 (24.45)	10**
Cultivated paddy land (%)	89.83 (23.47)	97.22 (14.32)	8**	85.10 (24.70)	95.13 (13.55)	12**

Note. Averages per household. Standard deviations in parentheses. Significance tests refer to a Student's t-test of the difference in means: * $p < .10$, ** $p < .05$, *** $p < .01$

Table 4
Adoption of improved crop varieties among resettled and host households 5-years after (2013) resettlement

Crops	Resettled Households ($n = 56$)	Host Households ($n = 52$)
Maize (%)	93.18 (25.50)	73.33 (44.72)
Rice - spring season (%)	16.67 (37.62)	21.57 (41.54)
Rice - summer season (%)	10.71 (31.50)	25.53 (44.08)

Note. Averages per household. Standard deviations in parentheses

mainly seasonal migration. Results from group discussions showed that many other adults thought about moving to find off-farm employment but this was not a promising option due to their low education, lack of expertise and limited skills.

Livelihood Outcomes

Five years after resettlement, the rice output had decreased significantly from 1.2 tons to 0.9 tons for resettled households, and from 2.0 tons to 1.7 tons for host households. This is because of the decrease in quantity and quality of paddy land area. As paddy land is limited, resettled households increased their sloping land area by reclaiming land from the forest, resulting in a considerable increase in maize output from 2.4 tons to 5.0 tons. Meanwhile, host households could not maintain the level of maize output and it fell from 6.2 tons to 4.5 tons.

Figure 3 shows that resettled households failed to maintain long-term sustainability in terms of incomes. The incomes of resettled households right after and five years after resettlement were significantly lower than those before resettlement (1,331 and 1,384 as compared with 3,909 US dollars). When including compensation payments, the income right after resettlement was significantly higher than that before resettlement and five years after resettlement. However, it should be noted that compensation payments are irregular and temporary and do therefore not reflect the adaptive capacity of households. Meanwhile, the net income of host households fell drastically from 2,852 to 2,085 US dollars, but was still significantly above that of resettled households.

The decline in household income for both groups resulted into increased food insecurity (Table 5). Five years after resettlement, the share of food insecure household increased from 7.1 percent to 16.4 percent for the resettled, and from 11.5 percent to 15.4 percent for host households as compared to right after resettlement. The per capita food energy consumed by both groups decreased significantly, while the standard deviations were higher, suggesting an increase in variation in food security. The percentage of purchased food in total food consumption decreased for both groups, which implies a higher dependency on own food production.

Determinants of Net Household Incomes after Resettlement

Factors influencing household income levels right after and five years after resettlement are presented in Table 6. We used the Variance Inflation Factor (VIF) to check for multicollinearity. The values of VIF are below 10 indicating no problem of multicollinearity. The Breusch–Pagan test is statistically insignificant indicating that heteroskedasticity was not a problem. Table 6 shows that membership of local groups or associations had a significant and positive effect on the incomes of resettled households. This was the most important variable in 2013 and the second important variable in 2009, explaining 11.6 percent and 5.9 percent of the variation in incomes, respectively. For the community living in a remote area as Muong Lum, this can be considered an important type of social asset through which households are able to improve their access to resources and to other key actors. Government payments were the next most important variable five years after resettlement, accounting for 11.4 percent of the variation in income level. These payments were an important financial source for resettled households to invest in production. However, this variable had no significant impact on their income right after resettlement because only a very small portion of the total payment was invested in production. Five years after

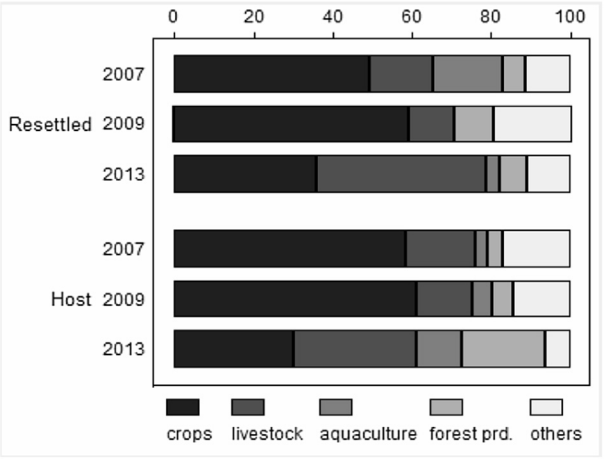


Figure 2 Income composition before (2007), immediately after (2009) and 5-years after (2013) resettlement, in percent of total household income
Note. "Other" includes off-farm and non-farm income

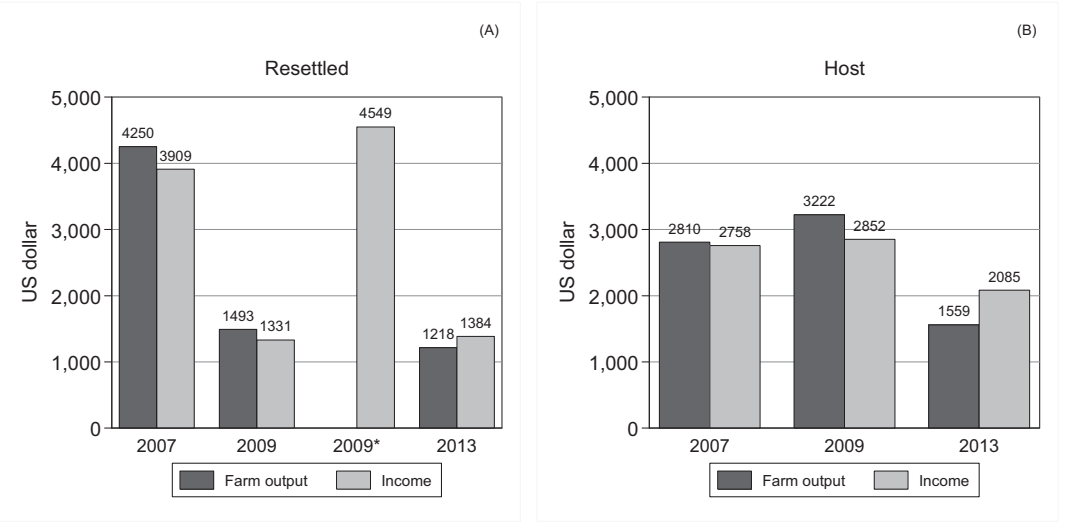


Figure 3 Gross annual farm output and household income of resettled and host households before (2007), immediately after (2009) and 5-years after (2013) resettlement
Note. * Household income with compensation and support payments

Table 5
Comparison of food security indicators for resettled and host households immediately after (2009) and 5-years after (2013) resettlement

Food security indicator	Resettled Households ($n = 56$)			Host Households ($n = 52$)		
	2009	2013	% change	2009	2013	% change
Food insecure households (%)	7.14 (26.20)	16.36 (37.33)	129	11.54 (32.26)	15.38 (36.43)	33
Food energy consumption (kilo calories/person/day)	4.28 (1.04)	3.19 (1.81)	−25***	3.90 (0.96)	3.02 (1.63)	−23***
Share of purchased food (%)	18.63 (16.98)	7.51 (15.26)	−60***	12.67 (11.16)	3.50 (4.58)	−72***

Note. Averages per household. Standard deviations in parentheses. Significance tests refer to a Student's t-test of the difference in means for continuous variables and a χ^2 test for binary variables: *** $p < .01$

resettlement, investment in planting cost had a strong impact on income but was much less important than right after resettlement, accounting for 10.3 percent as compared with 39.2 percent of the income variation. Meanwhile, the amount of arable land was significant in 2013 but insignificant in 2009, which contradicted expectations. Discussions with resettled farmers suggested they did not have a strong economic incentive to cultivate their

Table 6
Determinants of household income immediately after (2009) and 5-years after (2013) resettlement for resettled and host households

Explanatory Variables	Resettled Households ($n = 56$)				Host Households ($n = 52$)			
	2009		2013		2009		2013	
	Elasticity	% con.	Elasticity	% con.	Elasticity	% con.	Elasticity	% con.
Household size (persons)	1.49	0.47	6.14*	5.58	39.64***	24.71	18.85	8.05
Age of hhh (years)	−0.61	0.00	0.59	0.25	−1.20	−0.05	−7.09	−0.10
Education level of hhh (years)	−2.14	−0.58	1.86	−1.08	5.31	1.82	−3.26	−0.03
Participation in training programs (dummy)	9.03	2.54	−0.64	−0.40	11.64*	6.51	2.15	0.14
Membership of associations (number)	21.27*	5.86	4.12**	11.58	−4.48	−3.52	11.22**	6.16
Arable area (ha)	−7.13	−1.16	6.97*	9.17	−1.81	−1.30	−10.64	−3.88
Farm animals (TLUs)	2.80	0.20	3.76*	4.58	11.88**	13.06	10.28**	22.68
Number of credit sources (number)	−4.22	−0.03	5.75**	9.46	0.58	0.04	−2.76	0.54
Planting cost (US dollar)	16.26***	39.25	9.82***	10.27	34.51***	37.98	25.56***	36.15
Gov. payments (US dollar)	1.83	0.40	8.57*	11.43	–	–	–	–
Constant	2.50	–	2.29	–	−30.08	–	−0.02	–
Number of observations	56		56		52		52	
F-statistics	3.92***		6.84***		17.83***		10.73***	
Total explained (%)	46.54		60.85		79.26		69.70	
Minimum value of VIF	1.10		1.23		1.15		1.12	
Maximum value of VIF	2.62		2.09		2.84		3.00	
Breusch–Pagan/Cook–Weisberg test	$\chi^2 = 0.51$ p value = 0.475		$\chi^2 = 0.97$ p value = 0.325		$\chi^2 = 1.70$ p value = 0.1920		$\chi^2 = 1.84$ p value = 0.1745	

Note. * $p < .10$, ** $p < .05$, *** $p < .01$. hhh = household head; con. = contribution; gov. = government

arable land right after resettlement. Perhaps the large amount of cash received each month as compensation eroded their incentive to cultivate crops. Access to credit was an important variable in 2013 but was insignificant in 2009 probably due to the fact that resettled households received a large amount of government payments and they did not have demand for credit. Household size and farm animals had an impact on their income in 2013 but were insignificant in 2009.

For host households, investment in crop production was the most important variable both right after and five years after resettlement, accounting for 36.1 percent and 38.0 percent of variation in incomes, respectively. Farm animals had a strong impact on income in 2009 and was more important in 2013. Participation in local groups or associations also significantly affected household income in 2013, but was insignificant in 2009.

Discussion and Conclusion

The first five years following relocation is the time of adaptation. Our study found that five years after resettlement, resettled households could not restore their livelihoods or maintain themselves sustainably. Although they attempted to adjust their livelihood activities based on their individual resources and local conditions, their incomes decreased and food insecurity increased. Meanwhile, host households also experienced a decline of income and increase in food insecurity, mainly resulting from their loss of paddy land.

Right after resettlement or a few years after that, land scarcity was the major factor restraining livelihood improvement of the affected households. Land scarcity induced resettled households to intensify the use of chemical fertilizers as a primary mean to maintain crop output. However, this adaption strategy could not compensate for a sharp decrease in amount of agricultural land which still exposed host and resettled households to a decline in income and increase in food insecurity. In addition, this might be the suitable strategy which helped the households to improve livelihoods in short term, however, it would bring about negative environmental impacts which will affect livelihoods in the long term.

Beside land intensification, resettled households applied other adaptive strategies such as migration, and the adoption of new technologies. Households were constrained in using these strategies due to limited technical skills and financial capital. The road infrastructure was improved, but resettled households were unable to translate this into income gains. In addition, income diversification was used as an adaptive strategy to deal with land scarcity. Crop cultivation, a stable income source, was partly replaced by livestock rearing and forest product collecting, which is considered as an unstable income source.

In general, both host and resettled households seemed unable to recover their livelihoods after resettlement. In the resettlement plan, the direction of production development for resettled households in each resettlement zone is specified based on the local conditions. Muong Lum belongs to the resettlement zone of Yen Chau district, where the recommended key livelihood activities include development of food crops, fruit trees, industrial crops, cattle breeding and forest cultivation. However, from the data right after and five years after resettlement, we found that the government and local authorities seemed not to take any action to translate the plan into practice except providing resettled households with compensation and support payments. The quantitative data showed that there is a considerable discrepancy between the livelihood activities focused on by resettled households and that in the resettlement plan, and the livelihood patterns taken by resettled households converged with those of host households. To create sustainable livelihoods, the government should implement a range of measures to help resettled households build their livelihood assets using the compensation payments. It is clear that compensation payments alone are inadequate to rebuild livelihoods and maintain livelihood outcomes, and more support is needed to help create new income generating opportunities, involving job training and business development. The government should issue targeted remedial measures to support the affected communities in accordance with the local conditions while taking into account the disadvantageous characteristics of resettled people.

Conflict of interest

The authors declare that there are no conflicts of interest.

Acknowledgments

Financial support from Humidtropics, a CGIAR Research Program that aims to develop new opportunities for improved livelihoods in a sustainable environment is gratefully acknowledged. The work was also supported by core donors to the World Vegetable Center: Republic of China (Taiwan), Department for International Development (UK aid), United States Agency for International Development (USAID), Australian Centre for International Agricultural Research (ACIAR), Germany, Thailand, Philippines, Korea, and Japan.

References

Bui, T. M. H., Schreinemachers, P., & Berger, T. (2013). Hydropower development in Vietnam: Involuntary resettlement and factors enabling rehabilitation. *Land Use Policy, 31*, 536–544.

Cernea, M. M. (1997). The risks and reconstruction model for resettling displaced populations. *World Development, 25*, 1569–1587.

Cernea, M. M. (2008). Compensation and benefit sharing: Why resettlement policies and practices must be reformed. *Water Science and Engineering, 1*, 89–120.

Chilonda, P., & Otte, J. (2006). Indicators to monitor trends in livestock production at national, regional and international levels. *Livestock Research for Rural Development, 18*(8). Retrieved from http://www.lrrd.org/lrrd18/8/chil18117.htm.

Coates, J., Swindale, A., & Bilinsky, P. (2007). *Household food insecurity access scale (HFIAS) for measurement of food access: Indicator guide*. Retrieved from http://www.fao.org/fileadmin/user_upload/eufao-fsi4dm/doc-training/hfias.pdf.

Fields, G. S., Cichello, P. L., Freije, S., Menéndez, M., & Newhouse, D. (2003). Household income dynamics: A four-country story. *Journal of Development Studies, 40*, 30–54.

Government of Vietnam. (2004). Decision No. 459/QD-TTg, dated 12th may, 2004, of the prime minister of Vietnam on compensation and resettlement in Son La hydropower project. [in Vietnamese]

Government of Vietnam. (2013). Decision No. 2009/QD-TTg, dated 4th november, 2013 of the prime minister of Vietnam on master planning of resettlement in Son La hydropower project. [in Vietnamese]

Kevin, L., Longyi, X., & Mark, W. (2016). Spatial restructuring through poverty alleviation resettlement in rural China. *Journal of Rural Studies, 47*, 496–505.

Scudder, T. (2001). The World Commission on Dams and the need for a new development paradigm. *International Journal of Water Resources Development, 17*, 329–341.

Scudder, T. (2005). *The future of large dams: Dealing with social, environmental, institutional and political costs*. London, UK: Earthscan.

Singer, J., Pham, H. T., & Hoang, H. (2014). Broadening stakeholder participation to improve outcomes for dam-forced resettlement in Vietnam. *Water Resources and Rural Development, 4*, 85–103.

Webber, M., & McDonald, B. (2004). Involuntary resettlement, production and income: Evidence from Xiaolangdi, PRC. *World Development, 32*, 673–690.